

Lightweight, Cost Effective LOX Compatible Aerogel Insulation Material for Cryogenic Fluid Transfer Applications, Phase I

Completed Technology Project (2009 - 2009)



Project Introduction

Energy-efficient cryogenic insulation is an imperative requirement for the future of space travel. In order to advance the space program, NASA must find cost effective solutions to store and disperse propellants at cryogenic temperatures. The true cost for an insulation material depends upon the energy tradeoff between thermal efficiency and lifecycle maintenance for an insulation system. Durability is a critical factor for insulation systems because performance can degrade over time if appropriate attention is not given to environmental exposure and thermal cycling. Aspen Aerogels proposes to develop a cost effective, low density, aerogel insulation material that is liquid oxygen compatible for terrestrial LOX and LH2 pipes and feed lines applications. Besides its exceptional thermal insulation performance, these novel aerogels are super-hydrophobic and durable, affording a superior protective layer for the pipelines against environmental corrosion. During the Phase II Program, Aspen will further optimize the material and scale-up to production levels with a focus towards long-term applicability to replace conventional cryogenic insulation material in the pipelines and expand its use in other government and commercial applications. This novel insulation will reduce cryogenic storage costs by increasing the life expectancy of the system while decreasing the cost of installation and lifecycle maintenance.

Anticipated Benefits

The low cost aerogel insulation will be applicable and beneficial to industries ranging from aerospace to automotive, medicine, food processing, Chemical Processing and Appliances. Some specific applications are as follows: Medical: Energy efficient storage of cryogens for medical use is always of interest. Food Processing: In poultry and seafood processing, use of LN2 is quite common nowadays for quick freezing and preservation. Appliances: Refrigerators and freezers can use high performance aerogels insulation, either evacuated or unevacuated. The development and optimization of Aspen's low cost and durable aerogel insulation will be immediately useful for wide variety of cryogenic applications such as cryogenic tanks, transportation (pipelines) of cryogens and propellant, Mars exploration, near earth orbit spacecraft and also non-cryogenic applications such as high temperature insulation up to 500

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C. This material will be an excellent substitute for the expensive, heavy, and cumbersome vacuum jacketed MLI for cryogenic insulation onboard spacecraft as well as other applications where lightweight, durability and maintainability of insulation are important.



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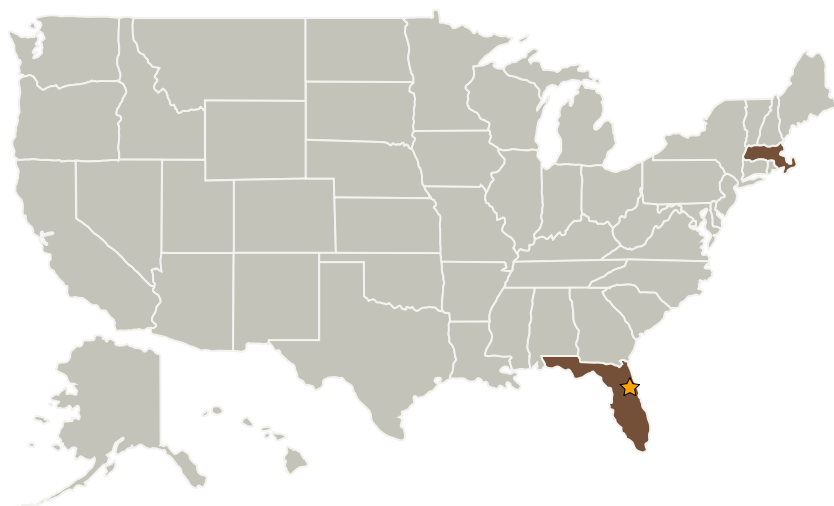
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Kennedy Space Center(KSC)	Lead Organization	NASA Center	Kennedy Space Center, Florida
Aspen Aerogels, Inc.	Supporting Organization	Industry	Northborough, Massachusetts

Primary U.S. Work Locations	
Florida	Massachusetts

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Kennedy Space Center (KSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Wesley L Johnson

Principal Investigator:

Redouane Begag

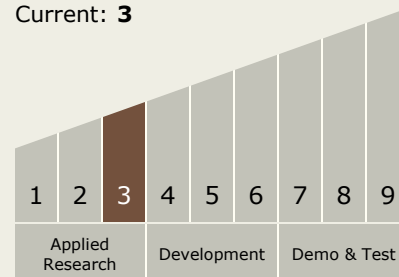
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Technology Maturity (TRL)

Start: 3
Current: 3



Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.1 Cryogenic Systems
 - └ TX14.1.1 In-space Propellant Storage & Utilization